

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

ON THE SCALES OF SOME MALACOPTERYGIAN
FISHES.

BY T. D. A. COCKERELL.

In the endeavor to trace the evolution and relationship of the scales of the Teleosts, and through these of the fishes themselves, it was obviously necessary to become acquainted with as many as possible of the families and genera of that great assemblage classed by Boulenger as Malacopterygii, and placed by him at the base of the Teleostean system. Many of the smaller Malacopterygian families, however, consist of fishes which are rare and difficult to obtain, and I could have made little progress but for the great kindness of Dr. G. A. Boulenger in sending me scales of *Notopterus*, *Heterotis*, *Pantodon*, *Phractolæmus* and *Knenia*,* and of Dr. D. S. Jordan in contributing scales of *Chirocentrus*. In some future paper I hope to figure all these scales, but the results of their examination are so interesting that they deserve to be put on record without delay.

Osteoglossidae.

Heterotis niloticus Ehrenb. Large oval scales with the exposed portion thick and corrugated, with a more or less vermiform sculpture; base rounded or narrowed (as in Mormyridæ), not at all truncate; radial sculpture throughout a large-meshed network, quite in the manner of the Mormyridæ, but better developed, and covering the basal as well as apical area; circuli resolved into granules, but in the lateral field remaining as well formed though moniliform lines. This is the only scale known to me, outside of the Mormyridæ, having the true Mormyrid form and pattern. Are we to see in the Osteoglossids the ancient type from which the Mormyrids came? There is a curious superficial similarity in the fishes themselves; thus compare *Mormyrops* with *Osteoglossum*, *Dapedoglossus* with *Petrocephalus*. The dif-

* Dr. Boulenger notes that all are from the middle of the side, above the lateral line

ferences in structure, however, are considerable, and I do not wish to suggest that the scales should count against a positive opinion of experts in fish-anatomy that the suggested relationship is impossible.

A chance to examine the other three living Osteoglossid genera is of course eagerly awaited.

Notopteridae.

Notopterus afer Gthr. Elongate (oblong) scales, with rounded corners; nuclear area far apicad; circuli extremely fine, the apical transverse; apical radii numerous but rudimentary, wholly submarginal; basal radii about 22, very long, very well developed, the middle ones inclined to be wavy; basal margin not at all scalloped. Boulenger compares this family with the Hiodontidae, and the scales are of the same general type, although readily separable. They do not at all resemble those of the Mormyrids or Osteoglossids. In general appearance, the Notopterids are very unlike the Hiodontids.

There is a distinct, even close, resemblance between the scales of *Notopterus* and *Gadus*. This is singular, because the Gadidae are supposed to have been derived from some Macrurid form, and the Macruridae are superficially much like the Notopteridae.

Macrurid scales I have never seen.

Pantodontidae.

Pantodon buchholzi Peters. Scales subcircular, with rounded but evident laterobasal angles; nuclear area a little apicad of the center; circuli very well developed, the apical transverse. With a microscope it is seen that the lateral and basal circuli are moniliform, the inner ones actually broken into separable minute elements, while the apical circuli are thickened near the nuclear area, much broken beyond, and lacking in the submarginal field. Radii few and very strong, more basal than apical, the latter more or less branched. In the radii, and general form, this scale is like that of the Alestini and the South American Characinids of the type of *Erythrinus*, *Hoplias*, *Pyrhulina*, *Chalceus*, *Chalcinus*, etc. It is also like one of the groups of *Barbus*. Boulenger states that the Pantodontidae are closely allied to the Osteoglossidae; the scales are very dissimilar, and yet agree well in the character of the circuli, which in both are moniliform or resolved into granules.

Phractolamidae.

Phractolamus ansorgii Boulenger. Scales also of the Alestiform type, with very strong laterobasal angles and few very strong radii; the truncate base is broad and crenulated. The circuli are dense and strong basally and laterally, but apically are very remarkable, every third or fourth being strong and conspicuous, while those between are evanescent, the whole being entirely longitudinal, the strong ones ending in short triangular teeth on the margin; between these strong circuli, in the subapical field, are scattered small circular pits.

Nowhere are the circuli at all moniliform. From the nucleus a radius extends on each side laterally, and from it spring three or four upwardly directed radii, following the lines of the apical circuli; two of these apical radii may start almost from the nucleus. There are three or four strong basal radii.

It thus appears that although the scales of *Pantodon* and *Phractolæmus* may both be described, on superficial characters, as Alestiform, they are extremely different in detail, the whole system of circuli being diverse. The scale of *Phractolæmus* is incipiently ctenoid.

Boulenger states that the Phractolæmidæ are an isolated group, nearest apparently to the Osteoglossidæ.

Kneriidæ.

Kneria cameronensis Boulenger. Minute subquadrate scales of a most peculiar type. At the sides are widely spaced longitudinal circuli, about four in number, and basally and apically are widely spaced radii; between the basal radii are numerous very irregular but mainly transverse broken lines, which seem to represent the circuli. In the middle of the scale, over a large area, the radii and other markings become very strongly zigzag, producing a very singular pattern. I do not know anything like this, unless it is the Rhodeine Cyprinidæ, in which the radii become more or less zigzag. There is a certain suggestion of *Umbra*, but on comparison it seems to be fallacious.

This family was formerly placed among the Haplomi, but in Boulenger's work on African fishes follows the Phractolæmidæ. The fishes have a Cobitoid appearance, but the scales do not resemble those of the Cobitids.

Chirocentridæ.

Chirocentrus dorab (Forsk.). Cavite, Philippine Islands. Scales altogether Clupeoid, differing however from all Clupeidæ seen in having the apical field with five transverse circuli, much less dense than those of the basal field, the latter sometimes evanescent. Transverse radii as in the Clupeids. One scale is elongate, the long basal field free from circuli, and with about twelve wholly longitudinal radii, which do not run to a nucleus, but connect with the apical radii. This must be abnormal.

